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(54) Multiple function thermodynamic fluid reservoir.

(57) The reservoir comprises a first portion (14) adapted to contain the liquid phase and having inlet and outlet fittings (13, 16), and a second portion (22) adapted to contain the gaseous phase and to the interior thereof there communicates at least one pipe (20) for conveying the gaseous phase fed from the evaporator (18) after completing a path within the first portion (14), the second portion (22) being provided with a small tube (24) having the inlet section thereof included in the second portion (22) at a suitable level and communicating to the exterior of the reservoir (15) for the recovery of the oil.

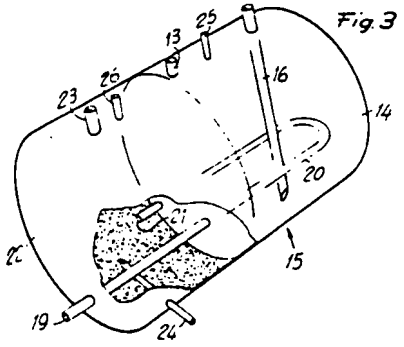

Fig. 3

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This invention relates to a thermodynamic fluid reservoir with multiple functions.

It is known that in refrigerating systems including as the basic component members thereof a refrigerating gas compressor, a condenser, a lamination valve, and an evaporator, some functions require to be performed which are presently delegated to different apparatus.

The first of such functions is that of effecting a heat exchange between the delivery line of liquid pressurized gas and the return pipe for the low temperature saturated vapors in order to render them dry; this function is presently performed by a surface heat exchanger.

The second function is that of effecting the separation of liquid particles present in the evaporated gas prior to the latter reaching the compressor, thereby conventional systems include a suitable liquid separating apparatus.

A third function is then that of effecting the recovery of the oil circulated with the refrigerating fluid to return it to the compressor, so as to make its lubrication optimal, thereby conventional systems include a special apparatus located on the compressor delivery side.

A fourth function is that of creating a build-up of the condensed liquid phase and,to this aim, it is current practice to provide a special reservoir.

Lastly, a fifth function is that of subcooling the condensed fluid.

The multiple apparatus provided in prior systems to perform the above-described functions, evidently involve a significant cost increase, while also increasing the chances of failure.

Accordingly, the task of this invention is to provide a multiple function thermodynamic fluid reservoir which affords a substantial simplification of the system by combining a plurality of functions, with attendant optimal utilization of the energy potential.

Within this task it is an object of this invention to provide a reservoir as indicated, which can be assembled with the greatest ease and is fully reliable in operation.

A further object of the invention is to provide a reservoir as indicated, which allows the thermodynamic fluid to be fed to the evaporator under a pressure, and consequently at a temperature, which is lower than those in current practice, with the possibility of further lowering the temperature through the system.

According to one aspect of the present invention, the mentioned task and objects are achieved by a multiple function thermodynamic fluid reservoir, characterized in that it comprises a first portion adapted to contain the liquid phase and provided with inlet and outlet fittings, and a second portion adapted to contain the gaseous phase and to the interior whereof there communicates at least one pipe for conveying said gaseous phase fed from said evaporator after completing a path within said first portion, said second portion being provided with

outlet fittings and there being provided a small tube with the inlet section thereof included in said second portion at a suitable level and communicating to the reservoir exterior for the recovery of the oil.

Thus, it will be apparent that in a reservoir of this type there have been combined in a single apparatus all the functions which are performed in the prior art by several apparatus, with savings in cost and a simplification of the system which are self-evident.

Advantageously, at the inlet fitting of the first portion, there is provided a bowl adapted to receive the fluid fed from the condenser and being equipped with a float connected to a fluid cut-off pin operative in a fluid intake bore to the reservoir.

Thus, the level of the pressure in the first reservoir portion is made independent of the pressure level in the condenser.

Further features and advantages will be apparent from the following description of some preferred but not limitative embodiments of the invention, given herein by way of example only and being illustrated in the accompanying drawings, where:

Figure 1 is a layout diagram of a refrigerating system of conventional design;

Figure 2 is a layout diagram of a refrigerating system which incorporates a reservoir according to this invention;

Figure 3 is a partly cut-away and ghost-line

perspective view of this invention;

Figure 4 is a perspective view of a first modified embodiment of the invention, wherein the bowl is located at the inlet fitting of the first portion;

Figure 5 is a side view of a second modified embodiment of the invention;

Figure 6 is a side view of a third modified embodiment of this invention;

Figure 7 is a side view of a fourth modified embodiment of the invention; and

Figure 8 is a side view of a fifth modified embodiment of this invention.

Making reference to Figure 1 of the drawings, indicated at 1 is the refrigerating gas compressor which supplies, over the line 2 to the oil trap 3,provided with a return line 4, and to the condenser 5, the fluid condensed through the heat exchanger 6, which is fed to the liquid reservoir 7 whence it flows through the lamination valve 8 to reach the evaporator 9.

The evaporated fluid is flown through the exchanger 6, thereby effecting a partial subcooling of the condensate, and is then fed to the liquid trap 10 whence it is drawn by the compressor 1.

It may be seen, therefore, how several discrete apparatus are provided in conventional refrigerating systems which can be eliminated through the invention which forms the subject matter of the present application.

With reference to Figures 2 and 3, indicated at 11 is the refrigerating gas compressor, the delivery side

whereof includes the condenser 12. The fluid condensate is conducted, through the fitting 13, to the first portion 14 of the reservoir, generally indicated at 15, which acts as a condensate reservoir, and is also provided with an outlet fitting 16 which draws from the bottom of said portion 14.

Upon flowing out through 16, the fluid reaches the lamination valve 17 and then the evaporator 18, to flow thereafter through 19 into the U-bent pipe 20 contained for a substantial portion within the portion 14 and communicating at 21 to the interior of the second portion 22 of the reservoir 15; thus, the heat exchange between the liquid phase fluid and return saturated vapors is accomplished along with the sub-cooling of the condensate.

Said second portion 22 of the reservoir 15, wherein the liquid particles present in the evaporated gas are separated such that they cannot reach the compressor, is provided with an outlet fitting 23 wherethrough the evaporated fluid is conducted, over a suction line, to the compressor 11.

The oil circulated with the refrigerating fluid is returned through a small pipe 24 connected to the compressor 11 by means of a line not shown in the figure, which has its inlet section at the most suitable level to drain the oil collected at the bottom of the portion 22 and floating over any liquid phase refrigerating fluid which may be present at the bottom.

Lastly, indicated at 25 and 26 are two fittings,

respectively, for a relief valve and fuse plug.

It will be appreciated from the foregoing description that the reservoir according to the invention can perform, with an extremely simple construction, those multiple functions which in prior apparatus were instead performed by discrete devices, which affords considerable savings in cost and overall size reduction, an advantage which reflects favorably on any likely applications, such as heat pumps, air conditioning, refrigeration, and many others.

Also to be noted is the ample capacity of the reservoir portion 14, which enables the use in the refrigerating cycle of water-cooled condensers no longer of the same type, as frequently employed in current practice, with a large space portion devoted to containing the refrigerating fluid, but rather of much reduced overall size and cost.

Figure 4 illustrates a reservoir 15 similar to the one shown in Figure 3, which incorporates the device effective to make the pressure level within the first portion thereof, intended for containing the liquid phase refrigerating fluid, independent of the pressure level in the condenser; this for the purpose of permitting the refrigerating fluid to be fed to the evaporator at a lower pressure, and accordingly lower temperature, than those currently practiced, so as to further cut down the system operating temperature level.

Said device comprises a bowl 27 connected to the inlet fitting 13 of the reservoir first portion 14 and having an inlet fitting 28 for the liquid phase

refrigerating liquid from the condenser. The bowl contains a float 29 whereto a pin 30, with a compensating spring 31, is connected which is effective to block with its conical tip 32 a bore 33 for admission of fluid from the bowl into the reservoir. Finally, indicated at 34, is a connection for a relief valve.

The bowl operation is self-evident: as the fluid from the condenser, under the pressure prevailing therein, by flowing through 28 reaches a certain level inside the bowl 27, the float 29 and associated pin 30 are raised, thus uncovering the bore 33 and allowing the fluid to the inlet fitting 13 in the reservoir portion 14, wherein a pressure level prevails which may be by any amount lower than the pressure prevailing in the condenser and bowl 27 prior to the uncovering of the bore 33.

The discharge of fluid from the bowl 27 causes the float 29 to move down and block the bore 33, so that the level of the fluid in said bowl rises and the above-described step is repeated.

Thus, through the provision of the cited bowl, it becomes possible to operate at a pressure of the liquid phase fluid within the underlying reservoir which is lower than the prevailing pressure in the refrigerating system condenser by a presettable amount.

Figures 5,6,7 and 8 illustrate some variations of the invention, each of them being clearly adapted to incorporate the bowl 27 of Figure 4; corresponding parts to those shown in Figure 3 are designated with

the same reference numerals.

In the modified embodiment of Figure 5, the evaporated fluid conveying pipe includes, where it goes through the portion 14 of the reservoir 15, a coiled section 35.

In the modified embodiment of Figure 6, the portion 22 of the reservoir 15 is located at the periphery of the portion 14, the pipe within said portion 14 being again in the coiled form.

In the modified embodiment of Figure 7, the evaporated fluid conveying pipe comprises, in its section inside the portion 14, a plate heat exchanger 36 which enhances the heat exchange effect.

In the modified embodiment of Figure 8, the portion 22 of the reservoir 15 is divided into two parts which are interconnected by the pipes 37 led through the portion 14; the evaporated fluid is admitted through the fitting 38 and discharged through the fitting 23.

The invention described hereinabove is susceptible to many modifications and variations in addition to those described above, without departing from the scope of this inventive concept. Thus, as an example, the evaporated fluid conveying pipe could have a finned configuration.

Furthermore, all of the details may be replaced with other technically equivalent elements. In practicing the invention, the materials used, as well as the shapes and dimensions, may be any suitable ones for the intended applications.

CLAIMS

1. A multiple function thermodynamic fluid reservoir, characterized in that it comprises a first portion (14) adapted to contain the liquid phase and provided with inlet and outlet fittings (13,16), and a second portion (22) adapted to contain the gaseous phase and to the interior whereof there communicates at least one pipe (20) for conveying said gaseous phase fed from said evaporator (18) after completing a path within said first portion (14), said second portion (22) being provided with outlet fittings (23) and there being provided a small tube (24) with the inlet section thereof included in said second portion (22) at a suitable level and communicating to the reservoir exterior for the recovery of the oil.

2. A reservoir according to Claim 1, characterized in that the outlet fitting (16) of said first portion (14) is arranged to draw from the bottom area thereof.

3. A reservoir according to Claim 1, characterized in that said at least one gaseous phase conveying pipe (20) within said first portion (14) has a U-like configuration and is located close to the bottom.

4. A reservoir according to Claim 1, characterized in that said at least one gaseous phase conveying pipe within said first portion has a coiled configuration (35).

5. A reservoir according to Claim 1, characterized in that said at least one gaseous phase conveying pipe within said first portion comprises a plate heat exchanger (36).

6. A reservoir according to Claim 1, characterized

by the provision of plural pipes (37) arranged to convey the gaseous fluid through said first reservoir portion (14) and connect to said second portion (22) as divided in two parts.

7. A reservoir according to one or more of the preceding claims, characterized in that said at least one gaseous phase conveying pipe within said first portion is a smooth design.

8. A reservoir according to one or more of Claims 1 to 6, characterized in that said at least one gaseous phase conveying pipe (20) within said first portion (14) is a finned design.

9. A reservoir according to Claim 1, characterized in that said second portion (22) is located adjacent one of the bottoms of the first.

10. A reservoir according to Claim 1, characterized in that said second portion (22) is located at the periphery of said first portion (14).

11. A reservoir according to Claim 1, characterized in that at the inlet fitting (13) of said first portion there is provided a bowl (27) adapted to receive the fluid from said condenser (12) and having a float (29) connected to a pin (30) for blocking a fluid intake bore (33) to said reservoir (15).

12. A reservoir according to Claim 11, characterized in that said pin (30) is provided with a compensating spring (31).

13. A reservoir according to Claim 11, characterized in that said bowl (27) has a relief valve fitting (34).

14. A reservoir according to one or more of the

preceding claims, characterized by the provision of fittings (25, 26) for a relief valve and fuse plug.

Fig. 1

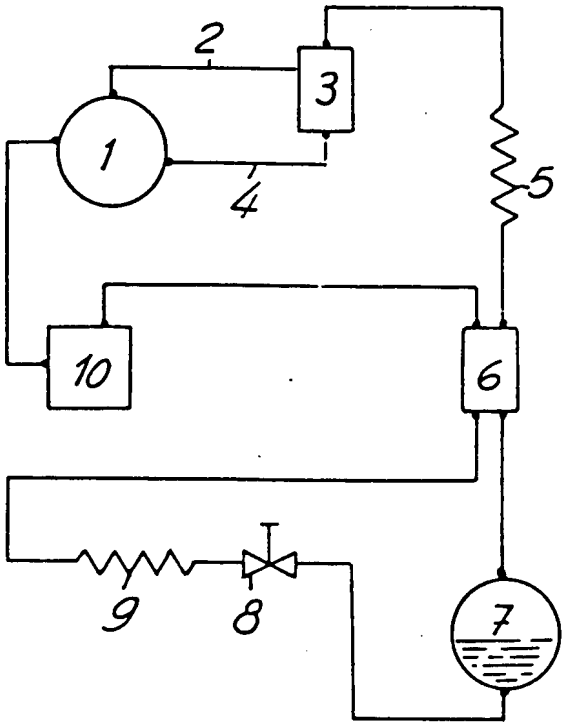


Fig. 2

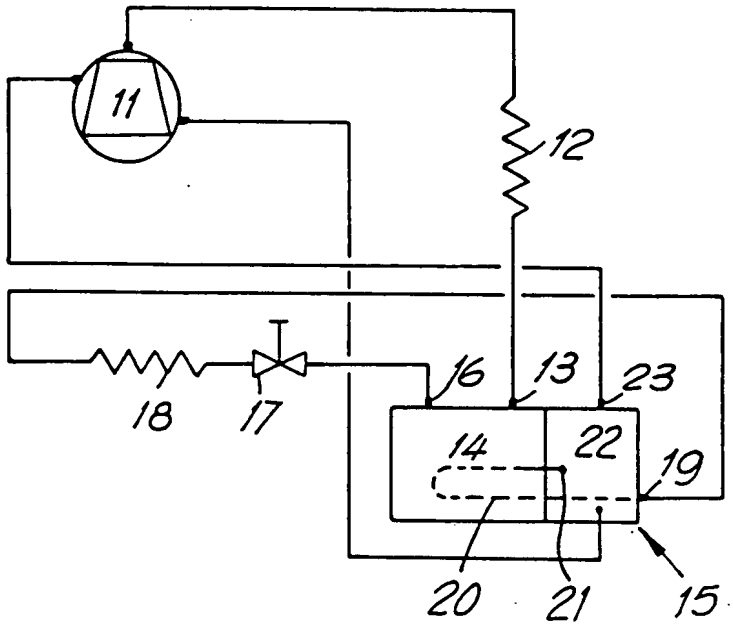
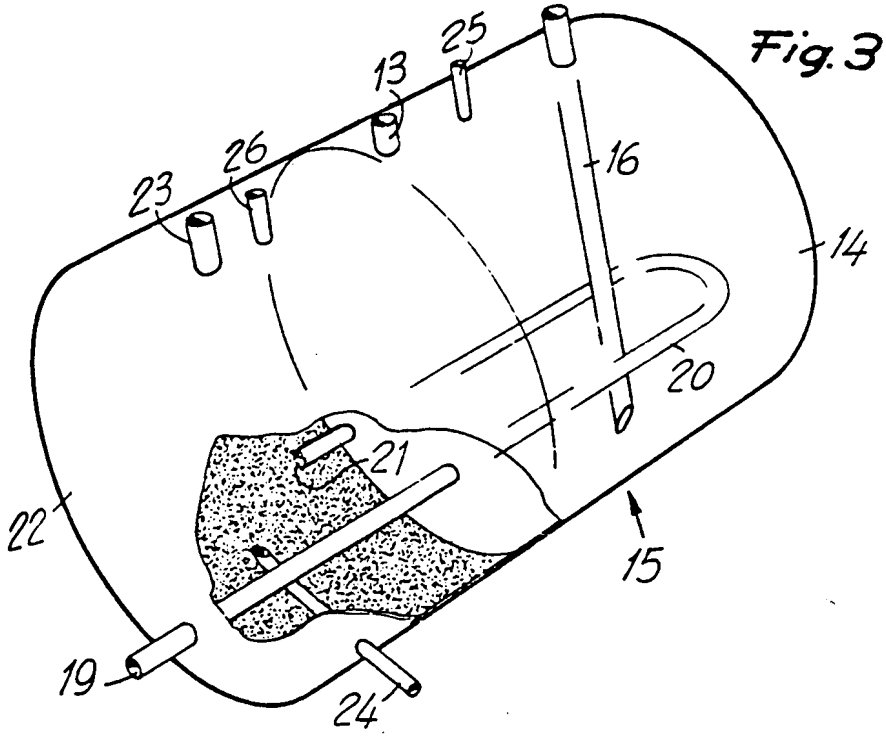


Fig. 3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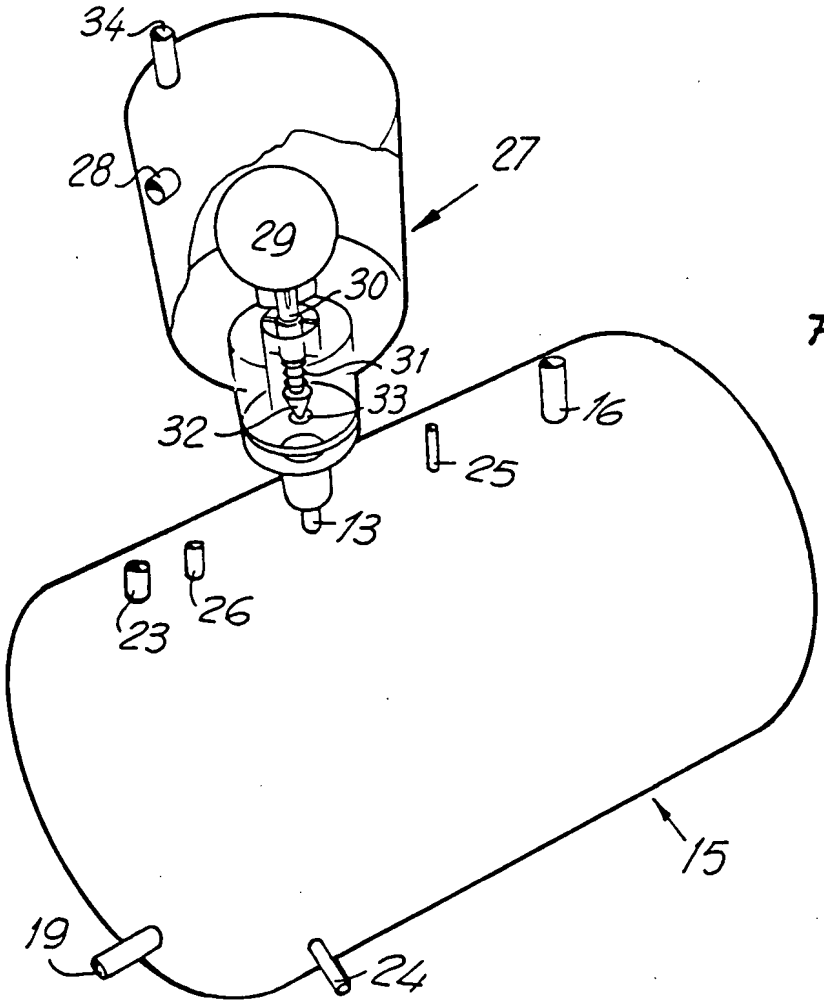
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Fig. 4

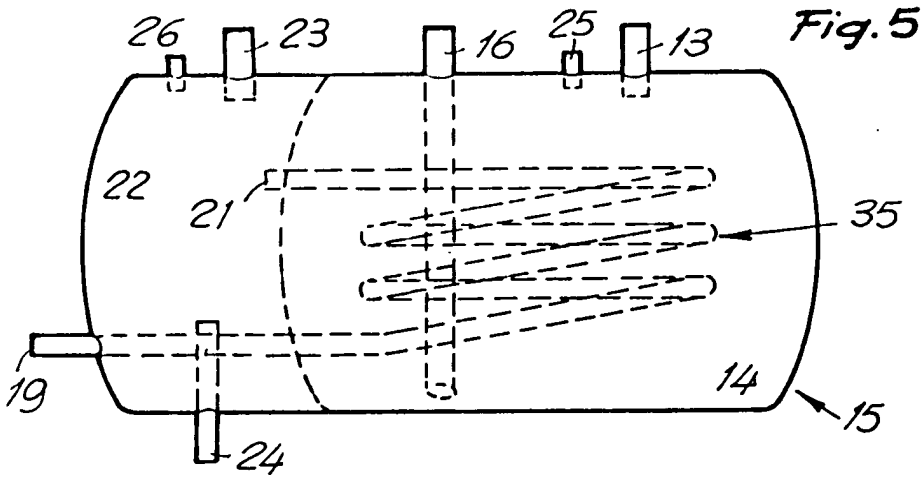

Fig. 5

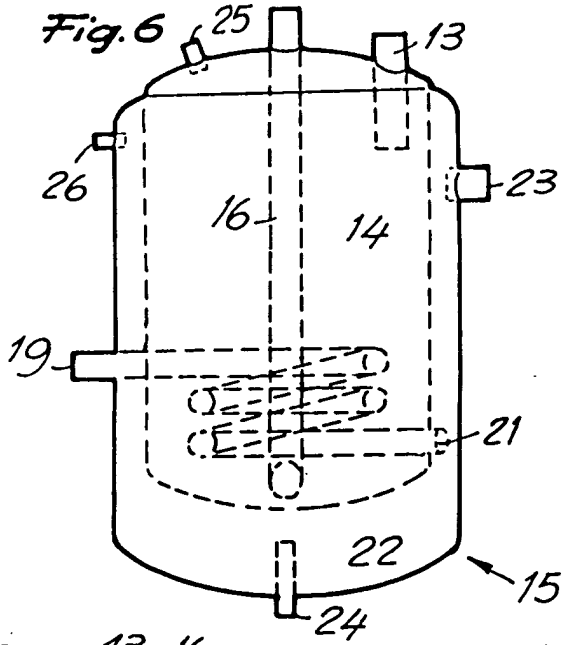

Fig. 6

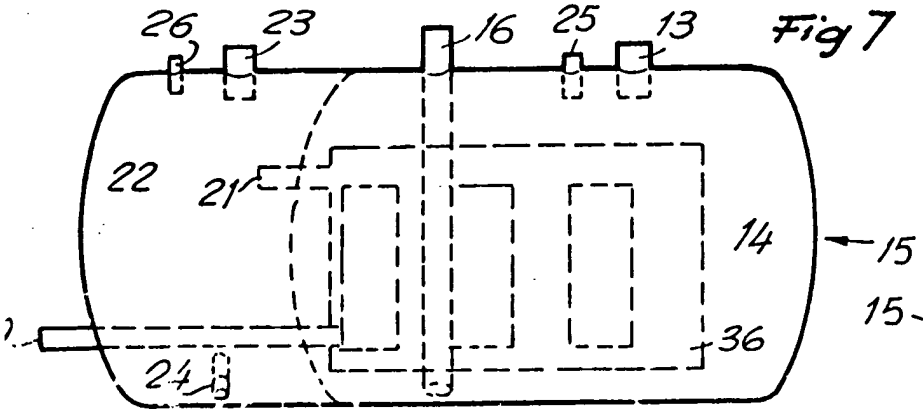

Fig 7

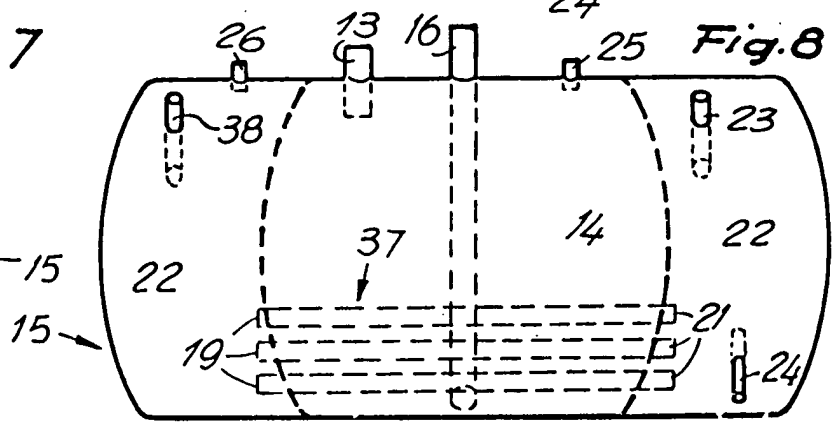

Fig. 8

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0071062
Application number

EUROPEAN SEARCH REPORT

EP 82 10 6188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-3 084 523 (E.W.BOTTUM et al.) *The whole document*	1,2,7, 14	F 25 B 43/00
Y		9,11, 12	
Y	DE-B-2 839 415 (R.LEMMENMEIER et al.) *The whole document*	9	
A		1,2,3, 7	
A	US-A-3 721 104 (R.M.ADLER) *Column 6, lines 35-67; figure 9*	1,2,7	TECHNICAL FIELDS SEARCHED (Int Cl ³)
A	US-A-3 131 553 (A.J.ROSS) *Column 3, line 34 - column 4, line 17; figure 3*	1,2,7	F 25 B
Y	BE-A- 350 475 (D.ODAM et al.) *The whole document*	11,12	
A	DE-A-2 602 582 (E.SCHULTZE et al.) *Figures 8,10,11,13*	4,6,8	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-11-1982	SILVIS H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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EUROPEAN SEARCH REPORT

0071062
Application number

EP 82 10 6188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
A	US-A-4 208 887 (R.L.MORSE et al.) *Figures 1-4*	5	
A	FR-A-2 205 659 (A.BRESIN) *Figure 1*	6	
A	US-A-2 628 478 (E.W.ZEARFOSS) *Column 5, line 45 - column 9, line 10; figure 4*	11	

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

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